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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/618,228	07/11/2003	Balgovind K. Sharma	SC12589TP	4406

7590

09/21/2005

John A. Fortkort P.C.
4512 Court of St. James
Austin, TX 78730

EXAMINER

TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 09/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/618,228	SHARMA, BALGOVIND K.	
	Examiner	Art Unit	
	Binh X. Tran	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 August 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 18 is/are allowed.
- 6) ☒ Claim(s) 1-17 and 29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8-19-2005 has been entered.

Claim Rejections - 35 USC § 102/103

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-5, 13-17, 29 are rejected under 35 U.S.C. 102(b) as anticipated by Sahbari (US 2002/0013239), or in the alternative, under 35 U.S.C. 103(a) as obvious over Sahbari (US 2002/0013239) in view of Filipozzi et al. (US 2004/0058626).

Respect to claim 1, Sahbari discloses a method for cleaning a semiconductor device comprising the steps of:

providing a semiconductor device having organometallic processing residues on a surface thereof (paragraph 0032);

removing the residues through the application of a surfactant solution (paragraph 0028).

Sahbari does not explicitly disclose the surfactant is a micelle solution. However, Sahbari clearly discloses the surfactant concentration is present in the amount of 0.2% to 5% wt (paragraph 0028). The term "micellar" (or micelle) is defined as an aggregate of surfactant molecules. Micelles only form when the concentration of surfactant is greater than the critical micelle concentration (CMC) (See prior art of record in previous office action). In paragraph 0022, applicants disclose that it is possible to form a micellar solution having the surfactant concentration less than 5%, preferable in the ranges of 0.01% to 1%. These concentrations certainly exceed the CMC. Based on this information, Sahbari surfactant concentration (i.e. 0.2% to 5%) certainly exceeds the CMC. Since, the surfactant concentration exceeds the CMC, it is inherently the micellar solution would form.

In the alternative, Filipozzi teaches the CMC concentration for the surfactant solution is about 0.1 % or less to form a micellar solution in order to disperse the residues (paragraph 46, 60). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari in view of Filipozzi by using the micellar solution because it will enhance the residue removal process.

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Respect to claims 2-3 and 15-16, Sahbari teaches the semiconductor device contains plurality of opening (i.e. via), and the opening has processing residues on a surface thereof which are formed during the creation of the opening, and wherein the micellar solution is applied to the opening to remove the processing residue (paragraph 0023, 0028, 0039). Respect to claim 4, Sahbari discloses the processing residues include organometallic polymer (paragraph 0032, 0039).

Respect to claim 5, Sahbari discloses the semiconductor device has a low-k dielectric material includes hydrogen silsesquioxane (HSQ), and benzocyclobutene (BCB) (paragraph 0035). Sahbari does not explicitly disclose the dielectric constant for these materials. According to MPEP 2112.01, products of identical chemical composition cannot have mutually exclusive properties. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. It is known in the art that HSQ layer has a dielectric constant $k \approx 2.8$ (See Aoki US 6,423,148, col. 7 lines 40-43). Therefore, the examiner interprets that Sahbari implicitly discloses a semiconductor device has a bulk dielectric constant k below 3.0.

Respect to claims 13-14, and 17 Sahbari discloses the semiconductor device contains copper level and silicon, wherein the surfactant is used to clean the surface (paragraph 0043, 0053). Respect to claim 29, Sahbari discloses the solution does not contain hydroxylamine solvent (example 7, paragraph 0053; read on "devoid of hydroxylamine solvents").

Claim Rejections - 35 USC § 103

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5. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sahbari in view of Filipozzi.

Respect to claim 6, Sahbari discloses to use nonionic, anionic and cationic surfactants at the concentration of 0.2 wt% or 0.5 wt% (paragraph 0028, read on applicant's range of "less than about 1% by weight"). Sahbari fails to disclose that the surfactant is hydrocarbon surfactant. Filipozzi teaches to use non-ionic polyoxyalkylene ether having concentration of 0.01% (read on "hydrocarbon surfactant" at the concentration less than about 1%, paragraph 0060). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari in view of Filipozzi by using hydrocarbon surfactant because equivalent and substitution of one for the other would produce an expected result.

6. Claims 8-9, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sahbari or Sahbari/ Filipozzi as applied to claim 1 above, and further in view of Aoki (US 6,423,148).

Respect to claim 8, Sahbari and Filipozzi fails to teach the surfactant having at least one carboxyl group. However, both Sahbari and Filipozzi disclose to use nonionic, anionic and cationic surfactants. Aoki discloses to use anionic surfactant include carboxylic acid surfactant (col. 5 lines 57-67, read on "on "having at least one carboxyl group"). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari, or Sahbari / Filipozzi in view of Aoki by using surfactant having carboxyl group because equivalent and substitution of one for the other would produce an expected result.

Respect to claim 9, Aoki discloses the solution comprises oxalic acid to remove metal impurities at higher efficiency (col. 6 lines 35-45). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari or Sahbari/ Filipozzi in view of Aoki by using oxalic acid because it will enhance metal impurities removal process. Respect to claim 12, Aoki teaches to use either oxalic acid (as discussed above) or citric acid (col. 6 lines 40-45).

7. Claims 7, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sahbari or Sahbari /Filipozzi, as applied to claim 1 above, and further in view of DeYoung (US 6,641,678).

Respect to claim 7, Sahbari fails to disclose the micellar solution comprises a fluorocarbon surfactant. However, Sahbari clearly teaches to use nonionic, anionic or cationic surfactant (paragraph 0028). In a cleaning method, DeYoung teaches to use either carboxylic acid (anionic surfactant) or fluorocarbon surfactant (col. 6 lines 20-24). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari, or Sahbari / Filipozzi in view of DeYoung by using fluorocarbon surfactant because equivalent and substitution of one for the other would produce an expected result.

Respect to claim 10, DeYoung discloses the solution comprises aqueous solution of fluoro-surfactant and HF acid (col. 5 lines 22-35 and col. 6 lines 23-25). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari or Sahbari/Filipozzi in view of DeYoung by using aqueous solution of fluoro-surfactant and HF because it will enhance and facilitate the cleaning process.

8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sahbari or Sahbari/Filipozzi as applied to claim 1 above, and further in view of Bessho et al. (US 6,440,856).

Respect to claim 11, Sahbari fails to disclose that the solution comprise ethylene glycol monobutyl ether. However, Sahbari clearly discloses the solvent includes propylene glycol monomethyl ether (paragraph 0022). In a cleaning method using surfactant, Bessho teaches to use ethylene glycol monobutyl ether or propylene glycol monomethyl ether as a solvent (col. 9 lines 15-28). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Sahbari or Sahbari/Filipozzi in view of Bessho by using ethylene glycol monobutyl ether because equivalent and substitution of one for the other would produce an expected result.

Allowable Subject Matter

9. Claims 18-28 are allowed.

10. The following is a statement of reasons for the indication of allowable subject matter: The cited prior arts fail to disclose or suggest the step of removing residues by contacting residue with a micellar solution, wherein the micellar solution comprises, by weight, about 0.01% to about 1% hydrocarbon surfactant, about 1-10% citric acid, about 1-10% oxalic acid, in conjunction with all other limitation in the claim.

Response to Arguments

11. Applicant's arguments filed 7-5-2005 have been fully considered but they are not persuasive.

The applicants argues that the examiner improperly rely on an inherency argument in postulating that the surfactant of Sahbari are micellar solution. The examiner disagrees. Sahbari discloses the surfactant concentration of 0.2% to 5%. The examiner has shown that the critical micelle concentration of the surfactant is less than 0.1% (See discussion above). Since Sahbari surfactant concentration is exceed the critical micelle concentration, it is inherently than micellar solution would form.

The applicants also argues that HSQ is a class of polymer having various structure and composition. According to applicants, HSQ could refer to a material having a dielectric constant 3.9 to 4.5. The examiner recognizes that HSQ is a class of polymer materials. However, Sahbari clearly teaches to use "low-k" material such as HSQ (paragraph 0010). By definition, a low-k dielectric must have a dielectric constant k less than 3.9. Since, Sahbari teaches to use low-k HSQ (i.e. dielectric constant less than 3.9), the applicants argument of using HSQ with dielectric constant from 3.9 to 4.5 does not apply.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh Tran

Binh X. Tran